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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte ERIC R. HANSEN, RALPH A. SUPELAK,
JAMES R. TUTT and PETER F. WAY

Appeal 2009-003198
Application 10/719,423
Technology Center 3700

Decided: January 19, 2010

Before: WILLIAM F. PATE III, STEVEN D.A. MCCARTHY and
KEN B. BARRETT, *Administrative Patent Judges*.

PATE III, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF CASE

Appellants appeal under 35 U.S.C. § 134 from a rejection of claims 1-29 and 31-34. App. Br. 1. We have jurisdiction under 35 U.S.C. § 6(b).

The claims are directed to a mineral processing kiln and method for operation thereof. Claims 1 and 26, reproduced below, are illustrative of the claimed subject matter:

1. A method of operating a mineral processing kiln having an inclined rotary vessel, the method comprising the steps of:

introducing combustion air and combustible fuel in a sub-stoichiometric ratio through a lower end of the rotary vessel, and

introducing additional combustion air through an opening in a wall of the rotary vessel at a location between the lower end of the rotary vessel and an upper end of the rotary vessel.

26. A mineral processing kiln, comprising:

an inclined rotary vessel having a lower end and an upper end, the rotary vessel having an air inlet opening defined therein at a location between the upper end and the lower end thereof,

a preheating/precalcining assembly positioned proximate to the upper end of the rotary vessel, the preheating/precalcining assembly comprising a stationary vessel through which (i) mineral passes prior to advancement into the rotary vessel, and (ii) a kiln gas stream passes in contact with the mineral subsequent to advancement out of the rotary vessel,

a stationary hood positioned proximate to the lower end of the rotary vessel, and

a burner positioned proximate to the lower end of the rotary vessel.

REFERENCES

The prior art relied upon by the Examiner in rejecting the claims on appeal is:

Iken	US 3,488,700	Jan. 6, 1970
Brandvold	US 3,584,850	Jun. 15, 1971
Graat	US 4,255,115	Mar. 10, 1981
Baukal Jr.	US 5,413,476	May 9, 1995

REJECTIONS

Claims 26-29 and 31-34 stand rejected under 35 U.S.C. § 102 as anticipated by Brandvold. Ans. 3.

Claims 1-18¹ stand rejected under 35 U.S.C. § 103 as unpatentable over Iken and Graat. Ans. 4.

Claims 1-25 stand rejected under 35 U.S.C. § 103 as unpatentable over Brandvold and Graat. Ans. 5.

Claims 1-25 stand rejected under 35 U.S.C. § 103 as unpatentable over Brandvold and Baukal. Ans. 5.

OPINION

The rejection of claims 26-29 and 31-34, as being anticipated by Brandvold, and the rejection of claims 19-25, as being unpatentable over Brandvold and Graat or Baukal, are reversed.

In the non-final rejection mailed 11/29/06 the Examiner relied upon two different embodiments of Brandvold to conclude that claims 26-29 and 31-34 were anticipated. Non-final Rej. 3. Appellants contested the

Examiner's finding of anticipation because the different embodiments of Brandvold were never disclosed as useable together and therefore Brandvold did not disclose each and every element of independent claims 26 and 31 arranged as in the claim. *See Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631 (Fed. Cir. 1987); *In re Bond* 910 F.2d 831, 832 (Fed. Cir. 1990). App. Br. 6-8. The Examiner maintained the rejection of claims 26-29 and 31-34 in the Answer, however. Instead of interpreting portions of the figure 5 embodiment of Brandvold as the preheating/precalcining assembly operable to heat a mineral by contact with a kiln gas stream, the Examiner interpreted elements of the feeding means 20, including the feed tube 20d, and feed chute 20c, as that structure. Ans. 3, 8; Brandvold col. 6. ll. 45-60; fig. 1. The Examiner also relies upon this reasoning for rejecting claims 19-25 as being unpatentable over Brandvold and Graat or Baukal. Ans. 6. The Examiner opines that since a “[p]ortion of the hot exhaust gas from the kiln will travel into the section 20d through the outlet end of 20d for direct contact with the material inside the section 20d” it is reasonable to read this structure as the claimed “preheating/precalcinating assembly” of claims 19 and 26 and the “mineral feed assembly operable to heat lime mineral by contact with a kiln gas stream advancing therethrough” of claim 31. Ans. 9. Since, as Appellants point out, Brandvold does not explicitly state that a “[p]ortion of the hot exhaust gas from the kiln will travel into the section 20d” the Examiner's finding is based upon a theory of inherency. Appellants contend that the examiner has not established that the characteristic relied upon is inherent in Brandvold, because it is not necessarily present. *See e.g.*,

¹ The Examiner has withdrawn the rejection of claims 19-25 as being unpatentable over Iken and Graat.

In re Oelrich, 666 F.2d 578, 581-82 (CCPA 1981). Reply Br. 5-6. In light of these contentions, we do not reach the issue of whether the embodiments depicted in figures 1 and 5 of Brandvold are combinable. Our inquiry is instead restricted to whether the Appellants have established that the Examiner erred by finding that at portion of the kiln gas stream will necessarily travel into feed tube 20d.

The express, implicit, and inherent disclosures of a prior art reference may be relied upon in the rejection of claims under 35 U.S.C. §§ 102 or 103. “The inherent teaching of a prior art reference, a question of fact, arises both in the context of anticipation and obviousness.” *In re Napier*, 55 F.3d 610, 613 (Fed. Cir. 1995). The fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic. *In re Rijckaert*, 9 F.3d 1531, 1534 (Fed. Cir. 1993) (rejection reversed because alleged inherency was based on what would result due to optimization of conditions, not what was necessarily present in the prior art); *see also, In re Oelrich*, 666 F.2d 578, 581-82 (CCPA 1981). “To establish inherency, the extrinsic evidence must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.” *In re Robertson*, 169 F.3d 743, 745 (Fed. Cir. 1999) (citations and internal quotations omitted). In relying upon the theory of inherency, the Examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic *necessarily* flows from the teachings of the

applied prior art. *Ex parte Levy*, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990).

While the Examiner's suggestion that a portion of the kiln exhaust gas flows through Brandvold's feed tube, and therefore preheats the incoming material, is technically feasible, the Examiner has not established that such a condition is necessarily present based on Brandvold's teachings. It is also possible that the exhaust gas could be drawn in its entirety through pumping system 28 and out exhaust conduit 28d. Reply Br. 3-6; Brandvold col. 7, ll. 40-46. Additionally, it is possible that incoming material itself prevents any portion of the exhaust gas to flow through the feed tube 20d. Since the Examiner has not established that the characteristic relied upon is necessarily present in Brandvold we are constrained to reverse the rejections of claims 26, 31 along with dependent claims 27-29, 32-34 and 20-25 as being anticipated by Brandvold. Since the Examiner relies upon the same speculative assumptions to conclude that the subject matter of claim 19, along with depended claims 20-25, would have been obvious to one having ordinary skill in the art, we are also constrained to reverse the rejections of claims 19-25 as being unpatentable over Brandvold and Graat or Baukal.

The rejection of claims 1-18, as being unpatentable over Iken and Graat, or over Brandvold and Graat, are reversed.

Regarding the rejection of claims 1-18 as being unpatentable over Iken and Graat, and the rejection of claims 1-18, and 20 as being unpatentable over Brandvold and Graat, Appellants and the Examiner agree that Brandvold does disclose creating the claimed sub-stoichiometric conditions. Ans. 6; App. Br. 13, 19, 21. The Examiner opines that Graat

teaches “combustion takes place at an area between [area] 20 and burner with first combustion air 7 for incomplete combustion (i.e., sub-stoichiometric conditions) and at area 20 with second combustion air 12 supplied through port 20 for a complete combustion (i.e., super-stoichiometric combustion)(see col. 6, lines 10-46).” Ans. 6. The Examiner’s equation of incomplete combustion to a sub-stoichiometric condition is, again, a finding of inherency which Appellants dispute. Appellants contend that Graat only teaches ““combustion takes place with an excess of oxygen” which “by definition, does not create sub-stoichiometric conditions, but rather creates super-stoichiometric conditions.” App. Br. 13, 19, 21. We must therefore determine whether the Appellants have established that the Examiner erred by finding that Graat would have taught introducing combustion air and fuel in a sub-stoichiometric ratio into a vessel.

Firstly, the cited portion of Graat does not provide any indication that the combustion of fuel at the burner was necessarily incomplete. *Contra* Ans. 6, 12, 18. The fact that additional combustion or burning occurs when the medium introduced through ports 20 mixes with the hot flame gases could be attributable to the fact that the medium itself contains additional oxidizable substances. Graat col. 6, ll. 10-37. Secondly, even if complete combustion of the fuel did not take place at the burner, this does not necessarily mean that a sub-stoichiometric ratio was present. Other factors such as insufficient mixing of the reactants could produce this result. The primary purpose of Graat’s air injection downstream from the burner is temperature control, specifically cooling. In each instance that Graat describes the method of operating his device, Graat teaches burning the fuel-air mixture under stoichiometric conditions or with *excess* oxygen and not

with a sub-stoichiometric amount. Graat Abstract; col. 2, ll. 2-3, col. 4, ll. 61-63; col. 7, ll. 3-5. For these reasons the Examiner erred by finding that Graat disclosed introducing combustion air and fuel in a sub-stoichiometric ratio. Since the Examiner's conclusion of obviousness is based upon an erroneous finding of fact we are constrained to reverse the rejection of claims 1, 7 and 14, along with dependent claims 2-6, 8-13, and 15-18, as being unpatentable over Iken and Graat, or as being unpatentable over Brandvold and Graat.

The rejection of claims 1-18, as being unpatentable over Brandvold and Baukal is affirmed.

Appellants argue the rejection of claims 1, 2, 4-9 and 11-14 as being unpatentable over Brandvold and Baukal as a group. App. Br. 22. We select claim 1 as the representative claim, and claims 2, 4-9 and 11-14 stand or fall with claim 1. Appellants contend that there is no legally sufficient reason to combine the references. App. Br. 22-23. Appellants additionally contend that "the combustion system of Baukal will not function in the kiln of Brandvold" because "the secondary oxygen of Baukal must be introduced into the flame NOT at some location tens, if not hundreds, of feet away." App. Br. 23-24. Appellants additionally contend that "the proposed combination would not arrive at the [claimed] invention" because "neither Baukal nor Brandvold disclose the use of a sub-stoichiometric air-to-fuel ratio in the lower end of the rotary vessel." App. Br. 24-25. In light of these contentions we must determine whether Appellants have established that the Examiner erred by concluding that the subject matter of claim 1 would have been obvious to one having ordinary skill in the art.

We find that the following enumerated facts are supported by at least a preponderance of the evidence. *Ethicon, Inc. v. Quigg*, 849 F.2d 1422, 1427 (Fed. Cir. 1988) (explaining the general evidentiary standard for proceedings before the Office).

1. Brandvold discloses a mineral processing kiln 14 having an inclined rotary shell (a “vessel”) 14c. Col. 4, l. 73- col. 5, l. 5; col. 5 ll. 60-67; fig. 1.
2. Brandvold additionally discloses introducing combustion air and combustible fuel through a lower end 14b of the rotary shell 14c. Col. 6, ll. 8-19.
3. Brandvold additionally discloses introducing additional air through tuyeres 24e (disposed in an “opening”) in a wall of the rotary shell 14c at a location between the lower end of the rotary vessel 14b and an upper end of the rotary shell 14a.
4. Brandvold’s tuyeres 24e are arranged to spiral the incoming cooling air to rapidly mix it with the heating fluid. Col. 6, ll. 71-75.
5. Brandvold does not disclose any particular stoichiometric condition of the fuel and air mixture supplied to the heating means, nor does Brandvold disclose that the air introduced at tuyeres 24e is used for additional combustion.
6. Baukal teaches a method for reducing the NO_x levels of conventional burners, such as those used in rotary kilns, by staging combustion reactions. Col. 1, ll. 43-46; col. 2, ll. 45-50.
7. Baukal stages the combustion reactions by providing a burner 1 supplied with oxidant gas 5 and fuel 7 in the wall 3 of a combustion volume or

furnace. Baukal then introduces a second oxygen containing gas 15 into a flame 13 via a conduit 17 Col. 4, l. 51- col. 5, l. 3.

8. Baukal teaches that various variables affect the NO_x produced by a burner. These variables include the firing rate, the molar ratio of oxygen to fuel and the oxygen injection distance from the burner. Col. 7, l. 26 – col. 9, l. 10.
9. Baukal recognizes that the burner 1 may be operated above, below, or at, the stoichiometric level (i.e., 2.0 for O₂:CH₄). Col. 5, ll. 4-9; col. 5, l. 66 – col. 6, l. 4; col. 7, ll. 27-28; col. 7, l. 45. Baukal also recognizes that reducing the molar ratio of oxygen to fuel in the burner to a sub-stoichiometric level while maintaining the injection location constant, reduces the amount of NO_x produced. Table 4; col. 8, l. 5 - col. 9, l. 22.

The examiner bears the initial burden of factually supporting any prima facie conclusion of obviousness. The key to supporting any prima facie conclusion of obviousness under 35 U.S.C. § 103 is the clear articulation of the reason(s) why the claimed invention would have been obvious. The Court in *KSR International Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007) noted that the analysis supporting a rejection under 35 U.S.C. § 103 should be made explicit. The Federal Circuit has stated that “rejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006), cited with approval in *KSR*, 550 U.S. at 418.

The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.

KSR, 550 U.S. at 416. A *prima facie* conclusion of obviousness may be supported by a showing that the claims are directed to a process, machine, manufacture, or composition of matter already known in the prior art that is altered by the mere substitution of one element for another known in the field, and such modification yields a predictable result. *See id.* (citing *United States v. Adams*, 383 U.S. 39, 40 (1966)). The Court further stated that “[i]f a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill.” *KSR*, 550 U.S. at 417. When considering obviousness of a combination of known elements, the operative question is thus “whether the improvement is more than the predictable use of prior-art elements according to their established functions.” *Id.*

The subject matter of claim 1 involves no more than the application of Baukal’s known technique (Facts 6-9) to Brandvold’s known device (Facts 1-5) in order to achieve the predictable result of reducing NO_x emissions (*See* Facts 6 and 9) and therefore would have been obvious to one having ordinary skill in the art.

Since Baukal clearly describes the advantages of creating a sub-stoichiometric ratio of oxygen to fuel (i.e., below 2.0), namely reducing NO_x emissions, Appellants’ argument that there is no legally sufficient reason to combine the references is unpersuasive. *See* Fact 9. One of ordinary skill in the art would understand that when incorporating Baukal’s teachings into the device of Brandvold, it would not be necessary to incorporate the specific

location of the secondary air injection of either reference as Appellants suggest. Combining the *teachings* of references does not mandate combination of their specific structures. *In re Nieveld*, 482 F.2d 965, 968 (CCPA 1973). One of ordinary skill in the art would recognize that, while the location of the injected oxygen may affect NO_x emissions, reducing the oxygen to fuel ratio in the burner could reduce NO_x emission independent of the location of the injection. See Fact 9. Furthermore, one of ordinary skill in the art would recognize that the location of the secondary air need not be confined to Brandvold's tuyere location. One of ordinary skill in the art would understand how to properly locate the injected air in order to implement Baukal's teachings. Even if a location proximate the flames were required as Appellants suggest, such a location would still meet the claim which merely requires introducing additional combustion air between the vessel's ends. Appellants' final contention regarding claim 1, that Baukal does not disclose providing a sub-stoichiometric ratio, contradicts the express teachings of Baukal and is therefore unpersuasive. Fact 9.

Regarding the rejection of claims 3 and 10 as being unpatentable over Brandvold and Baukal, Appellants contend that the Examiner has not established that the claimed range would have been an obvious matter of design choice because Appellants "have clearly established where the claimed ranges solve a stated problem in a new or unexpected way." App. Br. 14. This argument is repeated regarding claims 15 and 22. App. Br. 26, 27-28. Thus, the next issue for our consideration is whether the Appellants have established that the Examiner erred by concluding that claimed ranges would have been an obvious matter of design choice.

“[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.” *In re Aller*, 220 F.2d 454, 456 (CCPA 1955). A particular parameter must first be recognized as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation. *In re Antonie*, 559 F.2d 618 (CCPA 1977). “The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the applicant must show that the particular range is *critical*, generally by showing that the claimed range achieves unexpected results relative to the prior art range.” *In re Woodruff*, 919 F.2d 1575, 1578 (Fed. Cir. 1990).

Baukal demonstrates that the molar ratio of oxygen to fuel injected at the burner as compared to the overall molar ratio of oxygen to fuel injected is a variable which affects the resulting amount of NO_x emissions. Fact 9. For combustion air having a fixed oxygen content the molar quantity of oxygen delivered to the burner is directly dependent upon the mass flow rate of the oxygen-containing combustion air delivered. Thus, introducing about 1% to about 15% by mass of the total combustion air downstream is essentially the same as introducing about 1% to about 15% by molar quantity of the total oxygen downstream. Baukal specifically mentions values within this range. See Baukal Table 4, claim 3. Even accounting for differences in oxygen content, one of ordinary skill in the art would recognize that optimization of the molar quantity of oxygen delivered to the

burner, as compared to the overall amount, could be effected by altering the proportion of air injected downstream, as opposed to at the burner.

Furthermore, there is no evidence in the cited portions of Appellants' Specification sufficient to show that the claimed range achieves any new or unexpected result. The claimed range is not even mentioned in the cited passage. App. Br. 14. Appellants have not established any criticality of the claimed range. For these reasons, Appellants have failed to establish that the Examiner erred by concluding that claimed ranges would have been an obvious matter of design choice.

Regarding claim 16-18 Appellants contend that "the Examiner has not shown where either Brandvold or Baukal discloses an air nozzle extending into the rotary vessel through an opening in the wall of the rotary vessel with such a nozzle being used to create super-stoichiometric conditions in the mid-portion of the rotary vessel." Claim 16 is chosen as the representative claim of this group and only requires "an air nozzle extending into the rotary vessel through an opening in the wall of [sic] vessel." Therefore, Appellants' argument is not commensurate with the scope of claim 16, and thus, for that reason, does not demonstrate error in the Examiner's rejection of claim 16. *See In re Self*, 671 F.2d 1344, 1348 (CCPA 1982) (limitations not appearing in the claims cannot be relied upon for patentability). Appellant has not provided any arguments as to why the recited limitations of claim 16 distinguish over Brandvold's structure, which shows tuyeres 24e extending into shell 14c through openings therein. Fig. 3.

DECISION

The rejection of claims 26-29 and 31-34, as being anticipated by Brandvold, and the rejection of claims 19-25, as being unpatentable over Brandvold and Graat or Baukal, are reversed. The rejection of claims 1-18, as being unpatentable over Iken and Graat, or over Brandvold and Graat, are reversed. The rejection of claims 1-18, as being unpatentable over Brandvold and Baukal is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a). See 37 C.F.R. § 1.136(a)(1)(iv) (2009).

AFFIRMED-IN-PART

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